CHAPTER 3: CRITERIA DEVELOPMENT

Overall Structure

GISST initially considered environmental vulnerabilities and potential impacts by using USGS watershed subunits called Hydrologic Unit Codes (HUC) (Cederstrand and Rea 1995). This watershed subunit is created by merging watershed area data and state stream segment information to form the base analytical unit. Depending on the state and locality, anywhere from an 8-digit to 14-digit HUC can be used. Higher level HUCs represent a finer grain than lower numbered HUCs (Cederstrand and Rea 1995). The mathematical algorithm has been used in several other EPA Region 6 applications and was used in GISST for consistency and ease of use (Osowski et al. 2001). The 1 to 5 scale, which is also consistent with other Regional programs, keeps the ranking system simple, with as small a number as possible to capture a sense of 'greater' or 'lesser' environmental concern or vulnerability (Osowski et al. 2001). Some criteria work as "on/off" buttons because only compliance is important and there no 'degrees' of legal compliance. However, certain projects may need to use a different geographical area (e.g., ecoregion, political boundary, transportation corridor). In these situations, the appropriate geographical area may not be the watershed or subwatershed level; however, the single media and cumulative nature of GISST still apply.

Criteria are evaluated using a mathematical formula, although different projects have used sums or averages of criteria. The individual criterion scores are extremely valuable in communicating EPA concerns. Key components are the total area of known projects in the watershed or appropriate

geographical unit (A_I), area of the watershed subunit, larger project area, or other geographical unit (A_{WS}), degree of environmental vulnerability (D_V), and the degree of industry-specific impacts (D_I) specific to each watershed subunit,larger project area, or other appropriate geographical unit. The unitless GISST algorithm is as follows: GISST = (Σ (A_I/A_{WS}))x D_V x D_I where

GISST = potential for significant environmental risk

A_I = total area of known projects

A_{WS} = area of watershed subunit, project area, or other geographical unit

D_V = degree of vulnerability for the watershed subunit, project area, or other

appropriate geographical unit (average of all D_V criteria*)

D_I = degree of impact produced by the project (average of all D_I criteria*)

*individual criteria may also be summed for a grand total, rather than averaged.

The individual criterion selected, including the area criterion, are dependent on the needs of and appropriateness to specific projects. For example, transportation projects use the general corridor where the road is to be placed rather than a watershed subunit. Other projects may use the county or other polygon instead of the watershed subunit and A_{WS}.

The development of criteria force decision-makers to determine the comparative risk of five options. In principle this is a very difficult process, and scores/criteria may cause disagreements or controversy. Ultimately, it is a way to systematically assess vulnerabilities and impacts cumulatively. GISST also makes stakeholders aware of what resources will be evaluated and the associated risk (score) that environmental assessors are willing to acknowledge. Screening models such as the GISST can lead to decisions to prioritize certain aspects of facility or project operations for environmental

review.

Area Criterion

$(\Sigma(A_I/A_{WS}))$ is the ratio of the cumulative area effected to the total area of evaluated watershed subunit or appropriate geographical unit, usually expressed as a percentage.

Vulnerability Criteria

The degree of vulnerability, D_V, is the sum of individual criterion scores divided by the number of vulnerability factors used (Osowski et al. 2001). The vulnerability criteria are intentionally unweighted reflecting a decision by GISST development team that the number of criteria used reflects the nature and purpose of the project for which it is used. In effect, the number of criteria for a certain environmental resource weights that feature more than an environmental resource with only one criterion. For example, one might use four water-related criteria, but only one economic criterion; therefore, the analysis would emphasize water issues. Since GISST is a screening level tool, it uses data already collected and in an electronic format. The data were often collected for another purpose; scientific study, permit application, or enforcement/compliance, for example. The application of a criterion is dependent on the availability of data for a particular geographic area. Consequently, a particular criterion may not be used until a viable data set becomes available. Many of the criteria reflect the questionnaire categories in Canter and Kamath (1997), although research was not available at the time the GISST was developed.

Impact Criteria

D_I is the sum of individual impact criterion scores divided by the number of impact factors used. They reflect industry specific impacts and not all may be used for a specific project. Many are also dependent on data and information from the individual facility or entity being evaluated (Osowski et al. 2001). Therefore, stakeholders must have a clear understanding of GISST and a willingness to participate by providing data concerning their operations.

Criteria Groups

Criteria, whether impact or vulnerability, can be placed into broad groups: water quality, ecological, air quality, socioeconomic, toxicity, CAFOs, pollution prevention, and enforcement/compliance. Enforcement/compliance criteria are seldom used in the every day uses of GISST within NEPA and are therefore not included in this user's manual. The individual criterion descriptions can be found in one of two appendices: Appendix A for finalized criteria and Appendix B for provisional criteria. There are many reasons why criteria are termed 'provisional.' Provisional criteria are those that have not been used, do not have a database to support their use, or are in the process of being developed, peer reviewed, and finalized. In some cases, provisional criteria are developed anticipating a future need, but no appropriate data are available. Please note that the underlying data and GIS coverages are dynamic and therefore the criteria may change as data sources become available.

<u>Water Quality</u>

The use of water quality criteria will give the user an overall sense of surface and ground water quantity and quality. Several different data sources were used (see Appendix A). Depending on the project, the user may not use all of the water quality criteria available or there may be a gap in which the user should develop a new criterion to meet his/her needs.

<u>Ecological</u>

This section includes criteria on wildlife habitat, endangered species, habitat fragmentation, and land use. In general, ecological criteria provide the user with what conditions are like for non-human organisms in the project area or geographical unit. They describe the landscape (large scale) and the project area (small scale). Several criteria in this section can be "flipped." For example, we have chosen large tracts of wildlife habitat as the most vulnerable condition. Conventional wisdom suggests that large unbroken tracts of habitat are better able to support large species (e.g., black bear), migratory species (e.g., bald eagle), and maintain the functioning of communities and ecosystems. Certain large migratory species may serve as "umbrella species" for smaller, less mobile species (e.g., amphibians, insects). This is appropriate given ecological theory; however, our regulations typically support the opposite. That is, that the most vulnerable condition could be the very small remnant patches of a particular habitat type. Without proper connectivity, however, small remnants of habitat will probably not support certain species.

Air Quality

The air quality section is one in which there are only a few criteria. Several criteria are under

development (Appendix B) to give the user more choices as compared to other sections.

Socioeconomic

Socioeconomic criteria are important for a number of reasons, including the requirements to

assess environmental justice, NEPA requirements, and to prepare an effective public involvement

strategy. Many of the criteria are useful for this last purpose, especially if English is not the primary

language or the literacy level of the community is not high. Socioeconomic criteria are important in that

an individual's place of residence, diet, exposure to occupational hazards, ability to receive adequate

health care (both preventive and post injury) may be controlled by income and education. For

environmental justice (Title VI complaints), only 3 criteria need be used (economic, minority, and total

population). For NEPA assessments, several others can be used to determine whether the proposed

project will have a beneficial or adverse effect on the local population. Other criteria help EPA staff

prepare an effective public education and involvement campaign.

Toxicity

Depending on the type of project the user is trying to assess with GISST, these criteria may be

very important. These criteria help to determine what pollution sources are in proximity to the

proposed project and the amount of releases (air and water) from facilities. In assessing cumulative or

aggregate health effects, these criteria become extremely important in the decision whether further field

investigations are needed.

CAFOs

The CAFO criteria section contains criteria focused on a specific industry. Therefore, these are all impact criteria designed to assess the environmental and pollution controls likely to be found at Concentrated Animal Feeding Operations (CAFO). In our usage of GISST, we have not developed criteria for other specific industrial sectors; however, other users may decide to develop their own impact criteria based on program needs and priorities.

Pollution Prevention

Several pollution prevention criteria have been developed, but are only included as provisional (Appendix B) because inadequate data sources exist. Once data sources become available, these criteria relating to energy usage, lighting, and auditing will be finalized and applied in appropriate projects (e.g., Federal facilities program).